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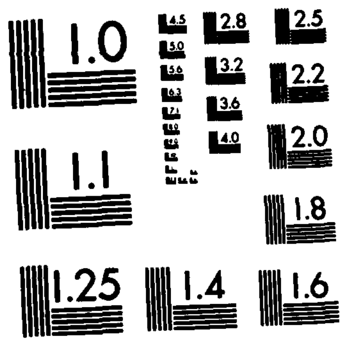
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REPORT SD-TR-83-68

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A Wideband Corner-Reflector Antenna for 240 to 400 MHz

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19 September 1983

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This technical report has been reviewed and is approved for publication. Publication of this report does not constitute Air Force approval of the report's findings or conclusions. It is published only for the exchange and stimulation of ideas.

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Project Officer

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The design and performance characteristics of a corner-reflector antenna capable of operation in the 240- to 400-MHz frequency range are described. The corner reflector is suitable for use as a standard reference antenna for wideband swept-frequency gain measurements. Measured VSWR, gain and patterns are presented.

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I. INTRODUCTION

In the VHF/UHF frequency region, a corner reflector provides a simple means of acquiring a unidirectional antenna with moderate gain [Refs. 1-6]. Generally, a corner reflector is fed with a half-wave dipole, and its operating bandwidth is restricted to about 15 percent. In an attempt to achieve broadband performance, the use of a log-periodic dipole array feed has been investigated with limited success [Refs. 7-8]. In this report, a corner reflector which employs an open-sleeve feed to provide broadband operation from 240 to 400 MHz is described.

II. DESIGN DESCRIPTION

For experimental purposes, two identical 90° corner reflectors were constructed with perforated aluminum sheets, 48 in. W × 41.13 in. L. The apex was slightly truncated to facilitate the construction and mounting of the feed as illustrated in Figures 1 and 2. To achieve broadband performance, an open-sleeve dipole was used as the corner-reflector feed. It consists of a conventional dipole with two closely-spaced parasitic elements (open-sleeves) as shown in Figure 2. The addition of these parasites extends the bandwidth of a conventional dipole from about 1.25:1 to 1.8:1. The broadband characteristics of the open-sleeve dipole have been reported in the literature [Refs. 9-10]. The sleeves were constructed with flat strips rather than cylindrical rods, although they should yield equivalent results [Ref. 10]. A close-up photograph of the feed is shown in Figure 3. Since the corner reflector is truncated with a 2-in. wide strip, the effective distance between the dipole and the true apex is 14.28" which corresponds to 0.291λ at 240 MHz and 0.484λ at 400 MHz.

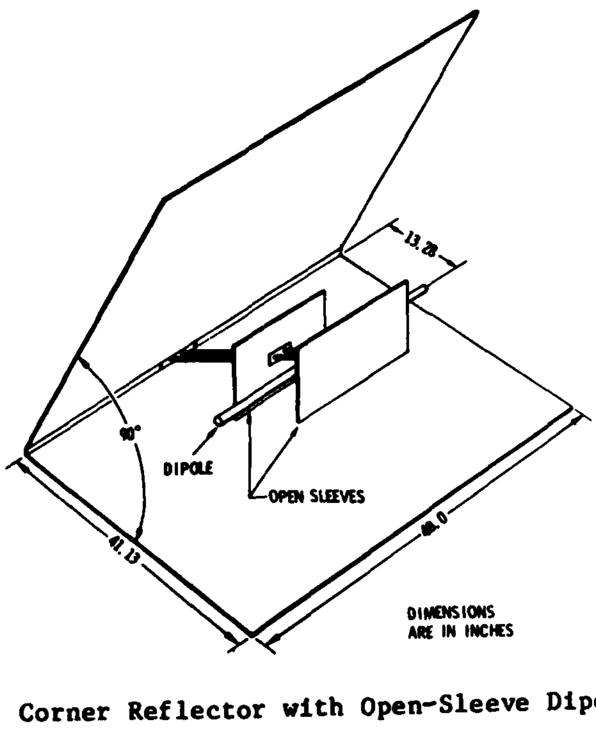

Fig. 1. Corner Reflector with Open-Sleeve Dipole Feed

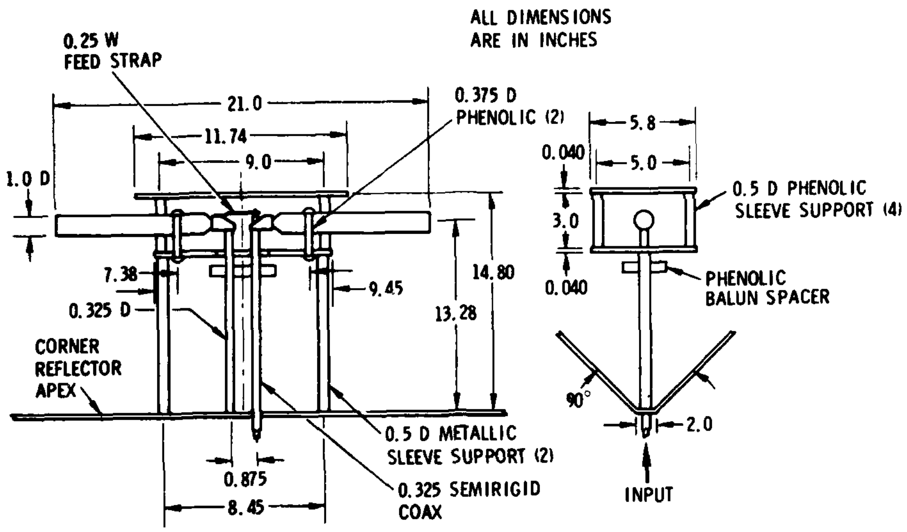

Fig. 2. Open-Sleeve Dipole Feed for Corner Reflector, 240 to 400 MHz

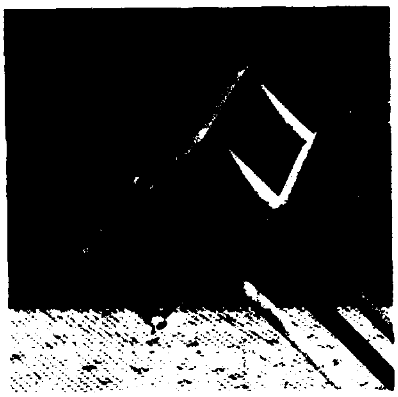

Fig. 3. Close-up Photo of Open-Sleeve Dipole

III. ELECTRICAL CHARACTERISTICS

The impedance or VSWR characteristics of the corner reflector were optimized over the 240 to 400 MHz band by varying the various parameters of the open-sleeve dipole feed; e.g., dipole and sleeve dimensions, sleeve-to-dipole spacing, and dipole-to-apex distance. Figure 4 shows the measured VSWRs of the two corner reflectors. The difference was caused by construction tolerances. The gain of the corner reflector was calibrated by using a swept-frequency, two-antenna method, and the results are depicted in Figure 5. To minimize the uncertainty caused by multipath and other instrumentation errors, the gain measurements were performed under various test conditions including variable range distance, different antenna orientations, etc. The swept-frequency data were sampled at 10 MHz intervals, and over 95 data points were obtained for each frequency. The maximum standard deviation is 0.13 dB, and the average is 0.095 dB. Typical measured E- and H-plane patterns of the corner reflector at 240, 290 and 400 MHz are shown in Figure 6. Generally, the patterns exhibit good front-to-back ratio characteristics with the worst case being ~23 dB at the lower edge of the band. The on-axis crossed polarization level was measured at 400 MHz and it was found to be ~-35 dB.

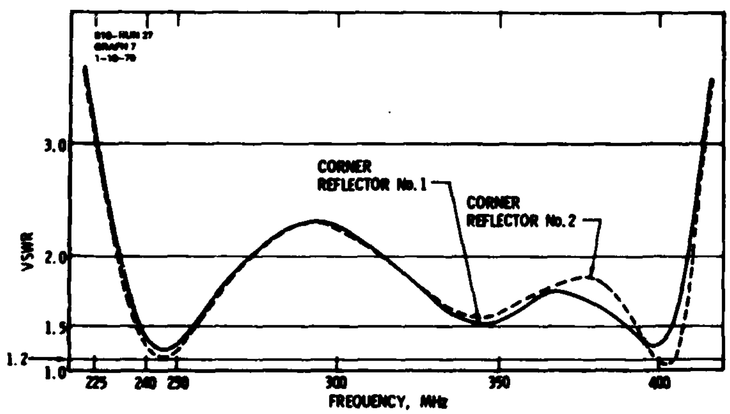

Fig. 4. VSWR of 4-ft Corner Reflector, Open-Sleeve Dipole Feed

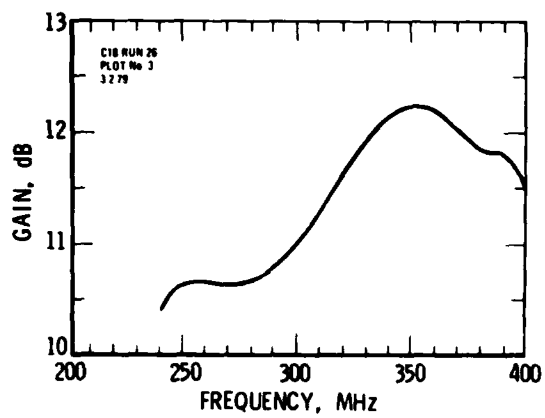

Fig. 5. Gain of Corner Reflector

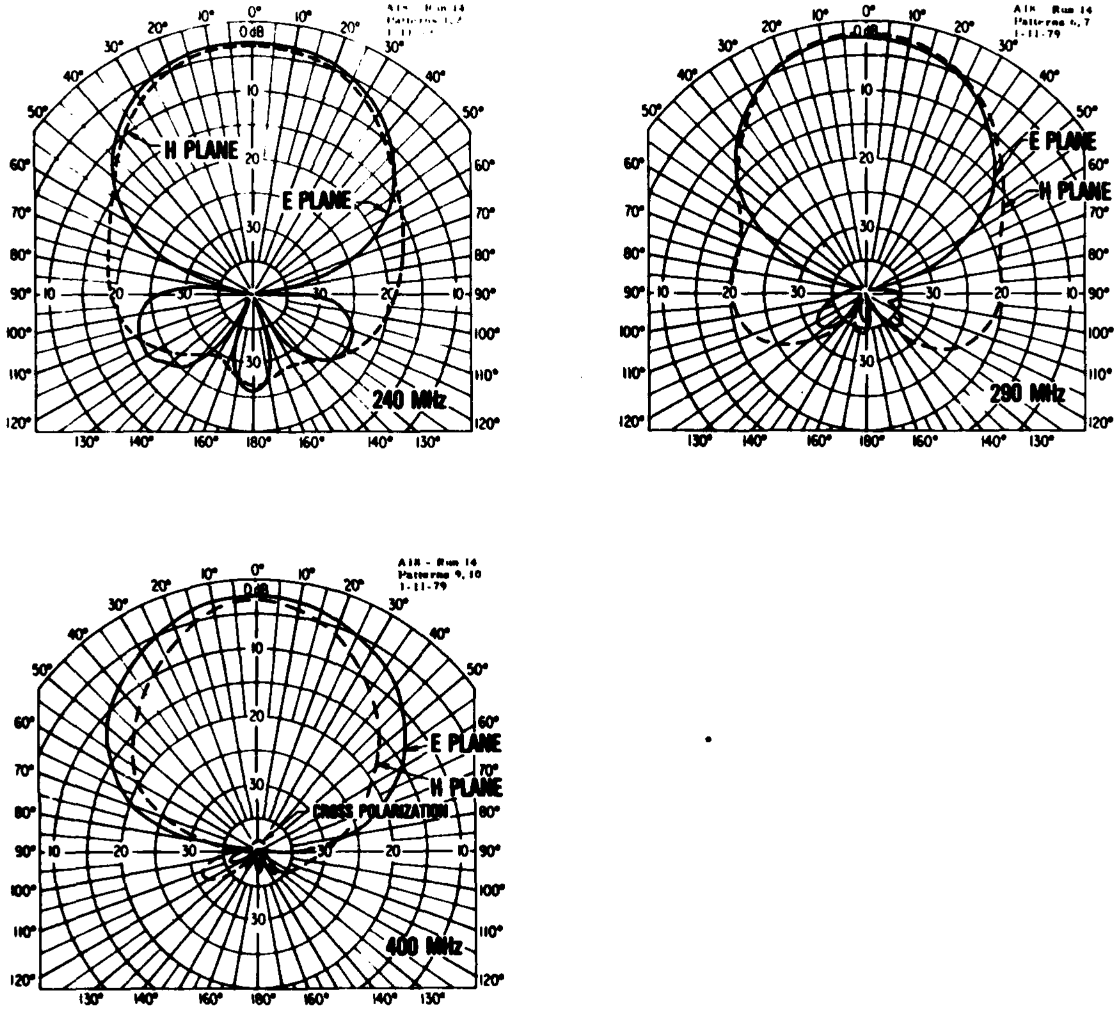

Fig. 6. Measured E- and H-Plane Patterns at 240, 290, and 400 MHz

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